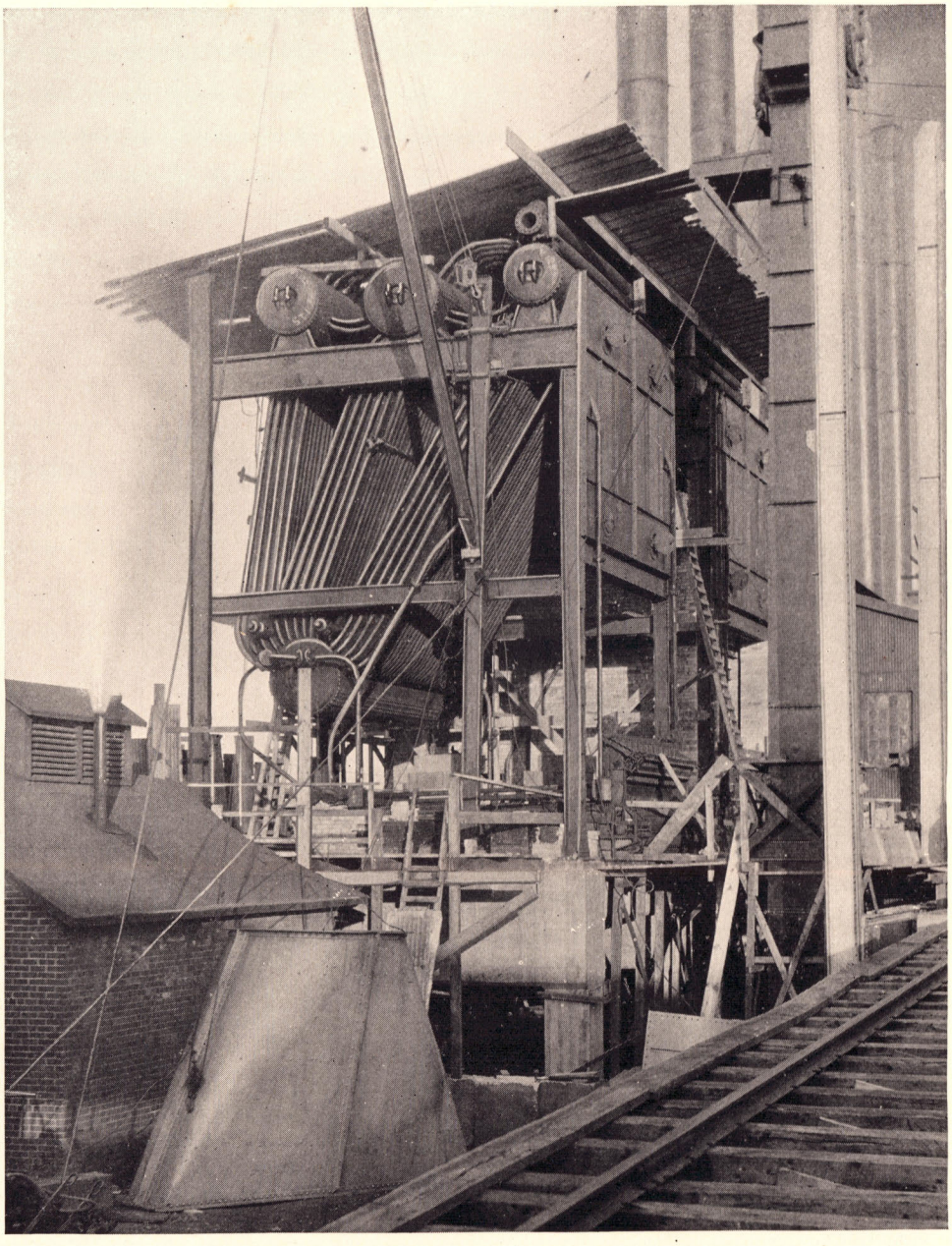
HEINE BENT-TUBE BOILERS

V-TYPE

WM. L. HOLE



Two Heine V-type 812-hp. Boilers being erected in a steel plant.

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HEINE BENT-TUBE BOILERS

V-TYPE CATALOG 54

COMBUSTION ENGINEERING CORPORATION
International Combustion Building
200 Madison Ave., NEW YORK

A Subsidiary of
INTERNATIONAL COMBUSTION ENGINEERING CORPORATION

FOREWORD

IN the forty-one years we have been building water-tube boilers we have acquired and maintained a reputation for superior construction. By proper choice of materials and plate thicknesses and by liberal use of both labor and material on our riveted joints and connections, we greatly prolong the life of our boilers. Furthermore, in certain instances by changing tubes, our boilers have been approved, years after they were put into service, for pressures higher than they carried originally.

Our first boiler was built in 1882 and ran in continuous service for thirty-four years. Afterwards it was repurchased by us and set up at our St. Louis shop as an exhibit. It is interesting to note that a boiler insurance company has approved this boiler for operation today at the same pressure for which it was designed forty-one years ago. This is only one of many examples of remarkable durability under service conditions, which have demonstrated the effectiveness of our methods of boiler construction.

All HEINE Boilers are built in either one of two shops, one located in St. Louis, Mo. and the other in Phoenixville, Pa. These shops are completely equipped for production of accurate work on a manufacturing scale. Many of the operations performed in our shops are of such a special nature that we have designed, built and patented machinery for our own use. As an indication of our policy of keeping up the

standards, in order to meet the constantly growing demand for boilers of higher pressure and larger size, we have recently added to our plant two additional buildings, equipped with cranes, drills, presses, and other modern machinery for heavy work, including a set of pyramid bending rolls which the makers tell us are the largest ever built.

As pioneers in the water-tube boiler field we have kept our place among the leaders in the industry by anticipating the requirements of power-plant engineers. We have three standardized types of boilers which are built in sizes to cover the complete range of horsepower and pressure demanded by present-day practice.

Heine Long-Drum Boilers — This type of boiler when equipped with horizontal baffles is denoted as the H-type and when equipped with cross baffles, as the HC-type.

Heine Cross-Drum Boilers — This type of boiler when equipped with horizontal baffles is denoted as the M-type, and when equipped with cross baffles as the MC-type.

Heine Bent-Tube Boilers — This boiler is built in a wide range of sizes, all of which are covered by the designation V-type.

These various boilers are each described in separate bulletins, any one or all of which we shall gladly send upon request.

From the beginning, HEINE Boilers have been built to serve and we have always recognized a responsibility for the performance of our product. To serve our customers we have continually enlarged the personnel and facilities of our engineering, field service and sales departments, and today we can render the power-plant industry better service than ever before.

We are furnishing the very best designs, materials and workmanship that modern engineering skill can produce, and try to help our customers to maintain the highest standards of performance. For, in this way only can we hope that our business will continue to grow and to prosper.

WM. E. HOLE

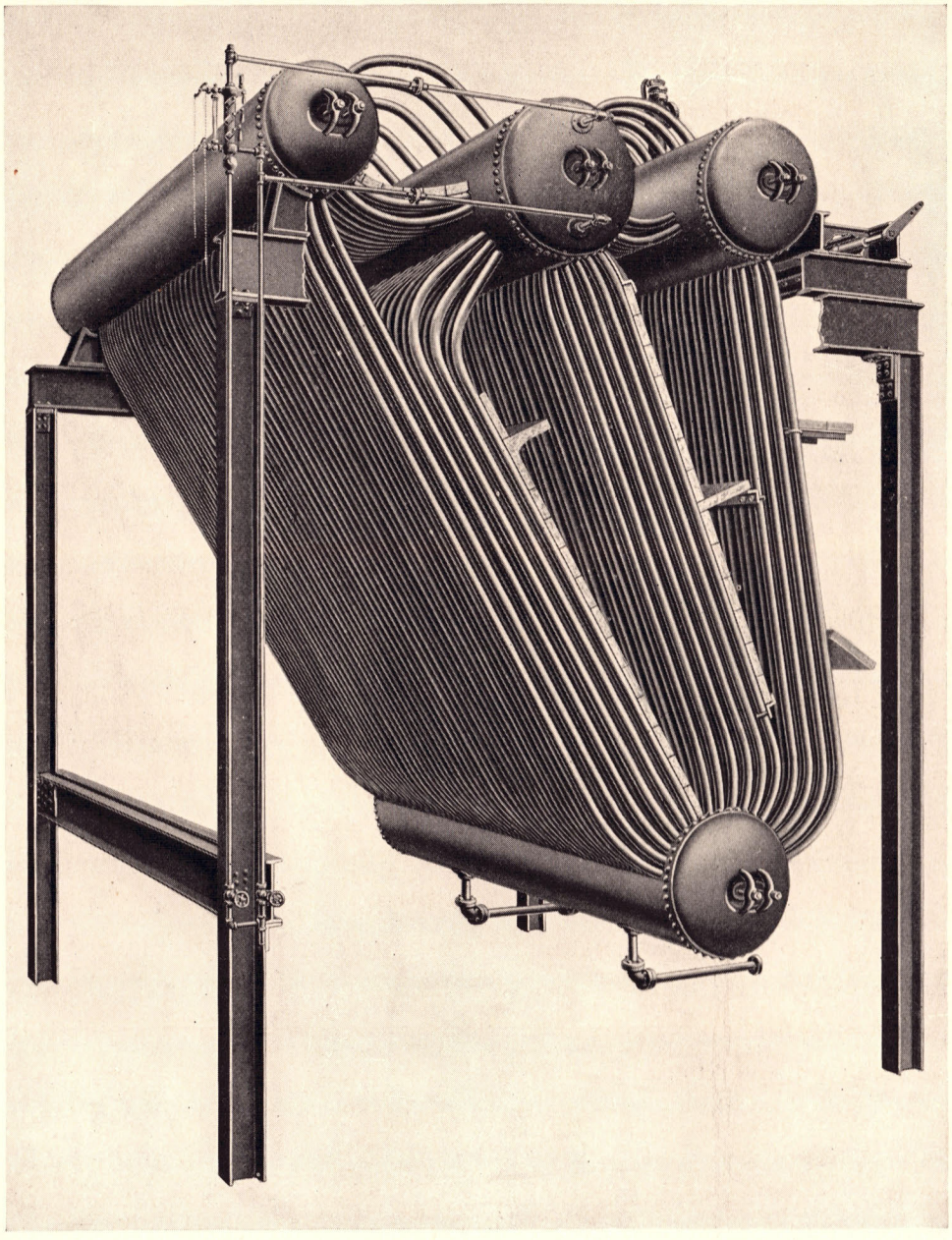


Fig. 1—Typical Heine V-type Boiler of the three-bank three-pass construction.

HEINE
V-TYPE BOILERS

RECOGNIZING certain fundamental advantages of the bent-tube type of boiler, this organization set its Research Department the task of designing a boiler of this type, that would not have the unfavorable overload capacity and steaming characteristics of the types previously built.

After exhaustive study, experimentation and testing with various arrangements and sizes of tubes and shells and different proportions of heating surfaces and circulation spaces the present line of HEINE V-type Boilers was developed, perfected and patented.

The salient features of these new boilers are given in the following text:

General Design

THE HEINE V-type Boiler consists of three upper steam and water drums and one lower water drum, all of which are interconnected by bent tubes acting as steam conductors or water circulators. The general arrangement of a three-bank V-type is shown in Fig. 1. The

upper drums consist of the front 36-in., middle 48-in. and rear 42-in. steam and water drums. These drums are interconnected with each other by one row of steam conducting tubes in the steam zone and by two rows of water circulators in the water zone.

The three upper drums are connected with the lower water drum by the three banks of long tubes. These tubes are always grouped in three banks for the three-pass boiler as shown in Fig. 1. The first bank contains six tubes, three of which enter the front upper drum and the other three enter the middle drum. All of the six tubes of the middle bank enter the middle 48-in. drum. The four tubes in the rear bank enter the rear drum. All of the tubes enter the lower water drum.

The baffles are placed on the sixth and twelfth tube, that is, the last tube in each bank. The smoke outlet is at the top of the setting parallel to and behind the rear upper drum. The gases therefore pass up the front bank of tubes, cross half of these in going into the second bank, down the second bank and then up the rear bank and out. It will be seen from the illustrations that this HEINE V-type Boiler confines the gases more closely to the tube banks at all points, and especially in the second bank, than is done in any of the bent-tube designs heretofore offered. The first and second bank of tubes do not have a large space between them as it is not intended to place superheaters in this space. The conventional knee tile can therefore be placed at the turn of the gases, and the projecting knee in the HEINE V-type is much shorter than would be required if the space for a superheater were provided between the first and second banks.

These boilers may be equipped with any of the modern automatic control systems for both furnace and boiler conditions. Then, too, they are unusually flexible in their adaptation to all manner of furnace designs. They will take any kind of stoker and may be used equally well with solid, liquid or gaseous fuel.

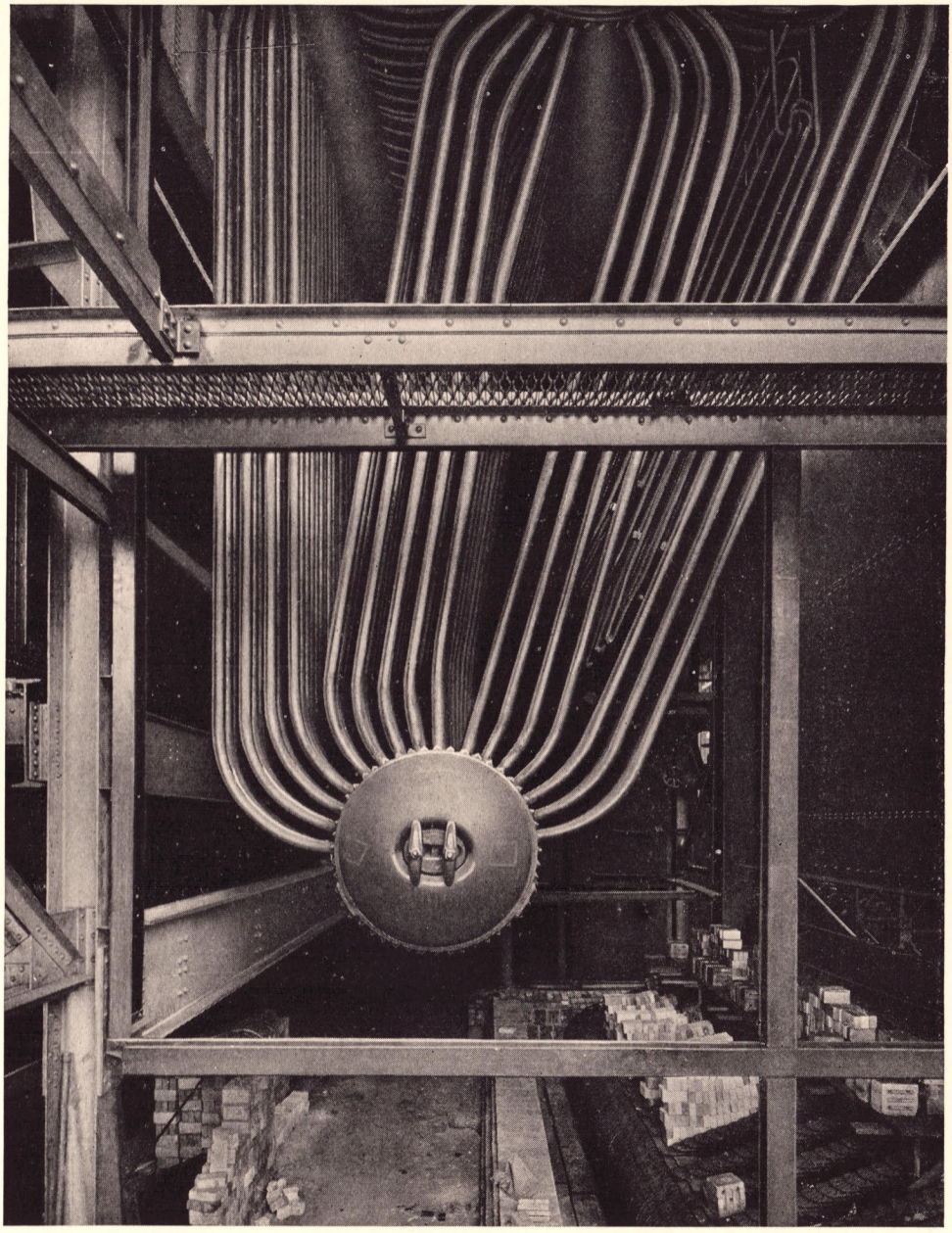


Fig. 2—Heine V-type 1500-hp. Boiler in process of erection in an electric power station.

Circulation

AT all times the greatest quantity of steam is made in the front bank and particularly in the front tubes of this bank. The water and steam mixture rises with greatest rapidity in these tubes. Therefore it is logical to carry only the front three into the front drum and to provide two water circulators to carry the water to the middle drum. The steam passes from the front drum into the middle through the row of steam connectors. The front drum is also higher than the middle drum thus still further insuring the separation of the steam and water. The inner three rows of the front bank discharge their steam and water directly into the 48-in. middle drum, the steam mixing with that from the first drum and passing to the rear drum in the steam conductors between the middle and rear drum. The water may pass down some of the tubes in the middle bank or over into the rear drum and down the rear bank back to the water drum. The course it takes depends upon the load on the boiler.

The circulation is normally upward in the middle bank excepting at very low ratings such as quarter or half load. The steam from this bank joins that from the first bank and passes to the rear drum through the rear steam conductors. This 48-in. steam and water drum is lower than the other two. This and several other features give the HEINE V-type greater water carrying capacity at the operating levels than is found in any other bent-tube design. The larger diameter also gives it the greatest steam disengaging surfaces because the level of the drum is so placed that the full diameter is used at middle gage. The water column connections are made to this drum.

The steam enters the rear drum behind a submerged baffle plate shown in Fig. 3. It travels around the ends of this plate back to the center of the drum where the drypipe and outlet are usually located, into the drypipe and out through the steam nozzle. The safety valve nozzles are also located on this drum. The feed water enters through

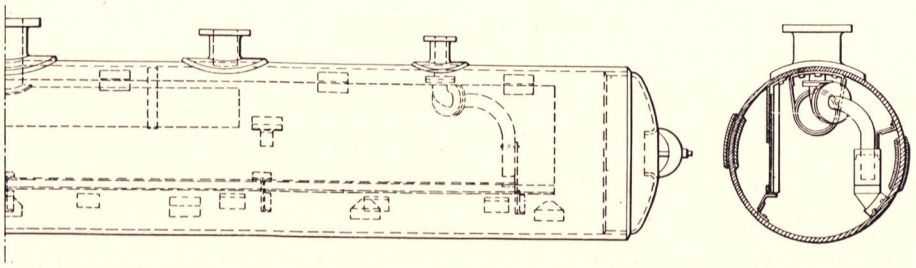


Fig. 3—Arrangement of steam baffle plate, drypipe, feed water distributing device and steam and feed nozzles.

the feed connection on the rear drum, is distributed in the equalizing device out of which it discharges into the main body of water and then passes down the rear bank of tubes to the water drum to be changed into steam in the other tube banks. The blowoff connections are made to flanged nozzles attached to the bottom of the water drum. All deposited impurities are blown off through these connections.

The arrangement of tubes and drums in the HEINE V-type Boiler overcomes the drawbacks of the present generally accepted designs of this type of boiler as has been demonstrated by the several thousands of boiler horsepower of HEINE V-type now operating in all manner of plants and under every type of load condition.

Four-Bank Type

CERTAIN classes of fuels and plant conditions require a boiler of a design that can be baffled for more than three passes. The HEINE V-type Boiler shown in Fig. 4 is arranged to meet these conditions.

The drums are the same size and located exactly the same way with respect to each other as in the three-bank type just described. The tubes are however re-arranged into four banks, the first having three, the second five and the third and fourth, four each. When the four-bank boiler is baffled as shown in Fig. 4 the outlet of the gases is at the bottom. This arrangement fits in very well where the existing gas flue

is below the boiler-room floor level or for an economizer located just above the floor. The four-bank boiler may also be arranged for either three or five passes with the smoke outlet at the top as shown in the inserts in Fig. 4. The water circulation in the four-bank boiler is the same as in the three-bank boiler. The four and five-pass boilers are more efficient than the three-pass, but have a greater draft resistance and therefore require higher stacks or higher induced draft.

Details of Construction

THE shells of HEINE V-type Boilers are made of single sheets rolled to a true circle and of a thickness necessary to carry the desired pressure. The longitudinal seams are double-strap butt joints. The heads are dished to a radius equal to the diameter of the shell so that no internal staying is required. At least one head in all sizes and both heads in the larger sizes are provided with 12 in. x 16 in. manholes, unless boilers are set in battery. The bends in all tubes are to a uniform radius of 30 in. and of proper degrees so that they enter the drums radially, thus giving a proper tube hole in the shell.

All tube and rivet holes are drilled from the solid plate. All rivets are driven by hydraulic riveters. (See Fig. 6). Forged steel pads are used for the smaller connections and heavy electric steel castings are used for the larger nozzles. All surfaces fitted to the shells are machine finished to true shape. Pressed steel covers are used on the manholes. All workmanship, dimensions and quality of materials are as good or better than the requirements of the A. S. M. E. Boiler Construction Code. In many instances we exceed the Code requirements, as for example, all of the steam and safety valve nozzles or saddles are attached with a double row of rivets. Then, too, the heads are made thicker than the Code requires. In fact, HEINE Boilers were built to these high standards long before there was a Code.

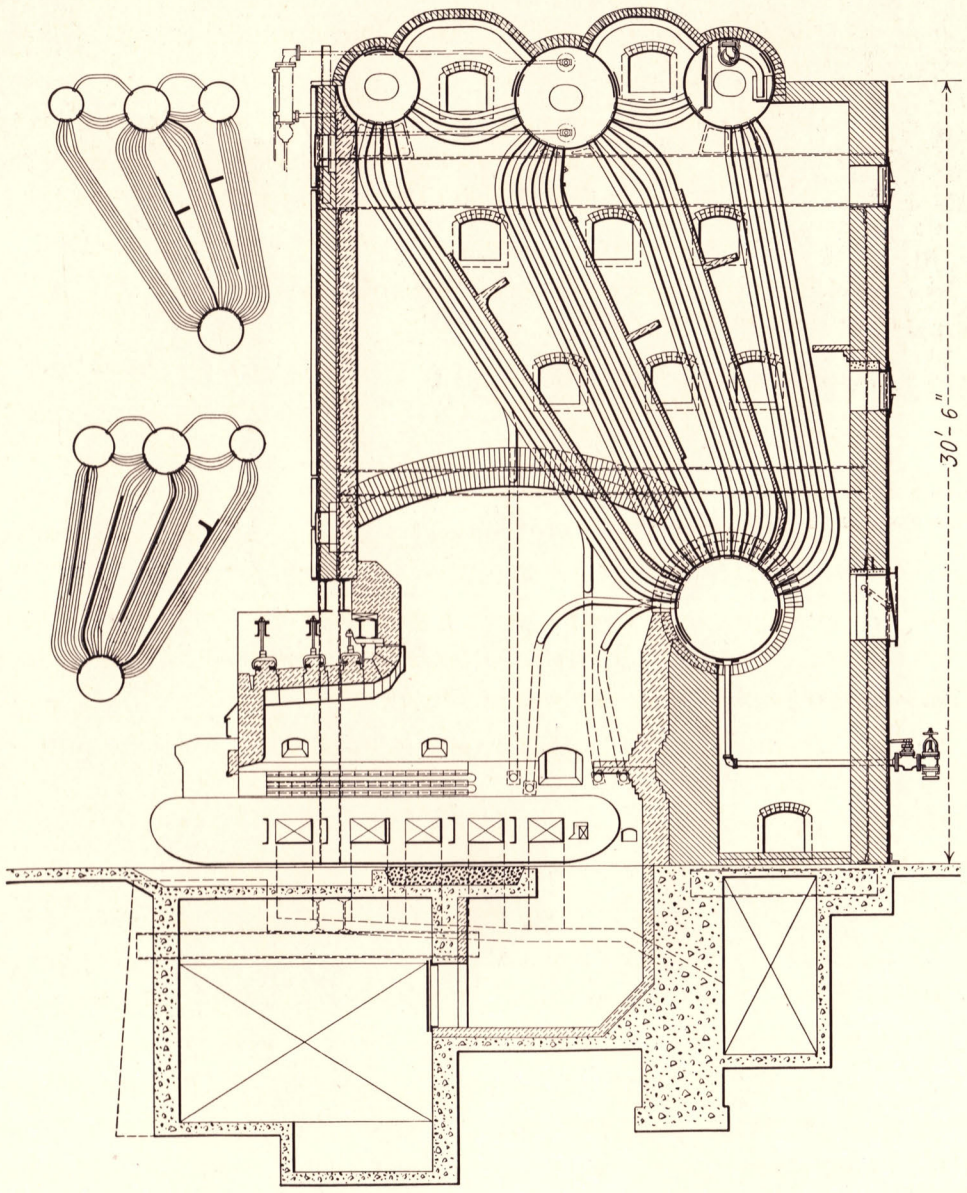


Fig. 4—Heine V-type 700-hp. Boiler built with four tube banks and baffled for four passes. This boiler is installed in a salt works. The same tube arrangement may also be baffled for three or five passes as indicated in the inserts.

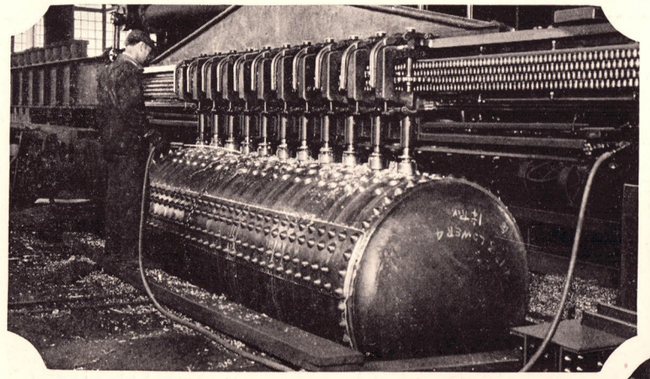


Fig. 5—The tube holes in all Heine Boilers are bored by machine, which assures accurate diameter and true location of every hole.

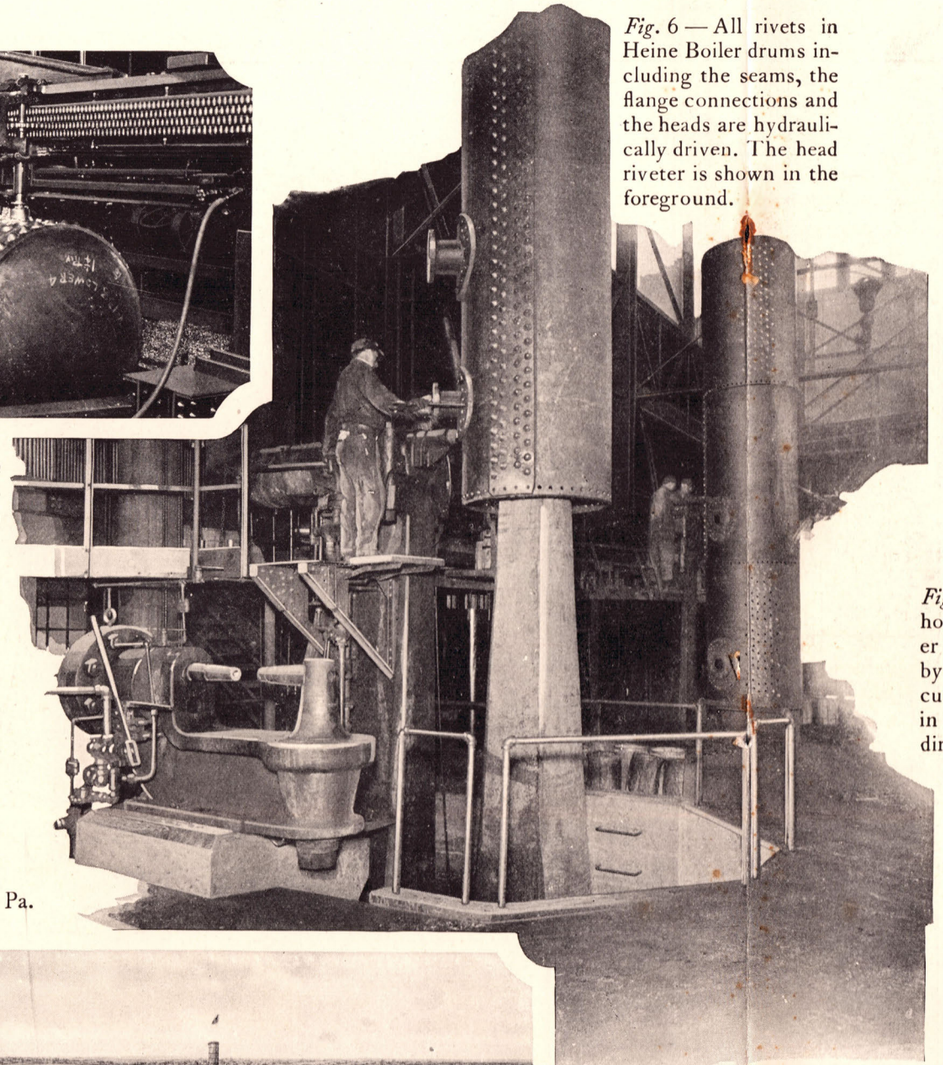


Fig. 6 — All rivets in Heine Boiler drums including the seams, the flange connections and the heads are hydraulically driven. The head riveter is shown in the foreground.

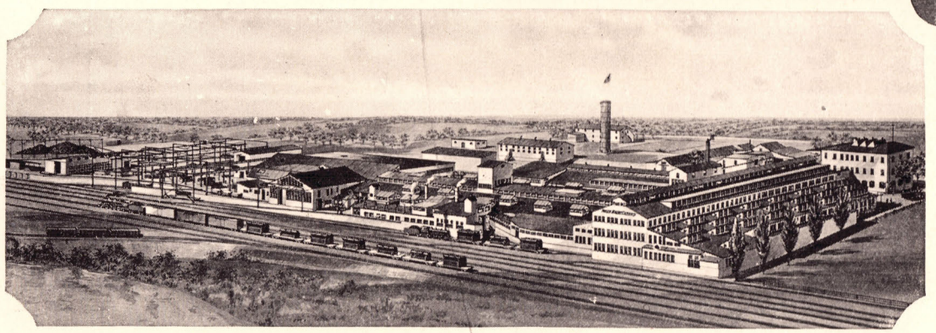
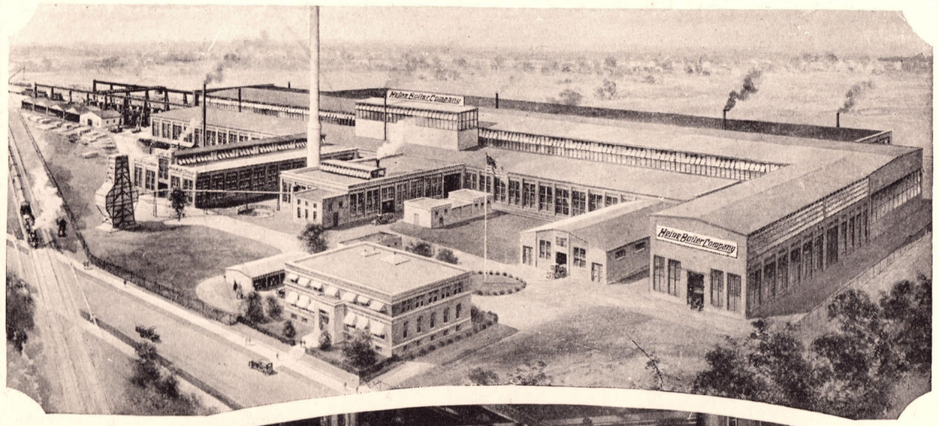


Fig. 7—Plant No. 2, Phoenixville, Pa.

Fig. 8—Plant No. 1, St. Louis, Mo.



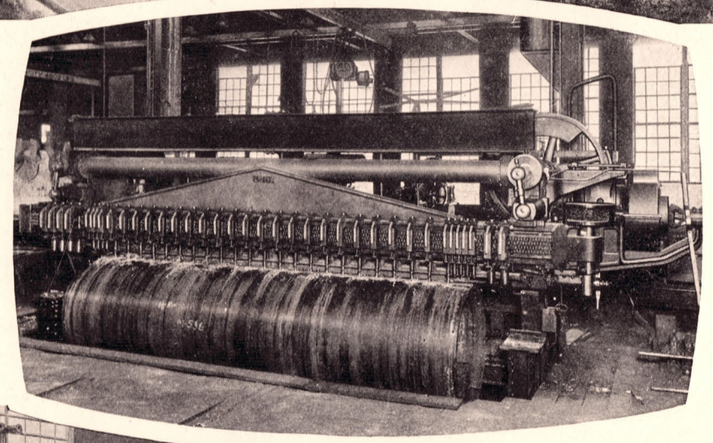


Fig. 9 — All rivet holes in Heine Boiler drums are drilled by machine to accurate diameter, and in true location and direction.

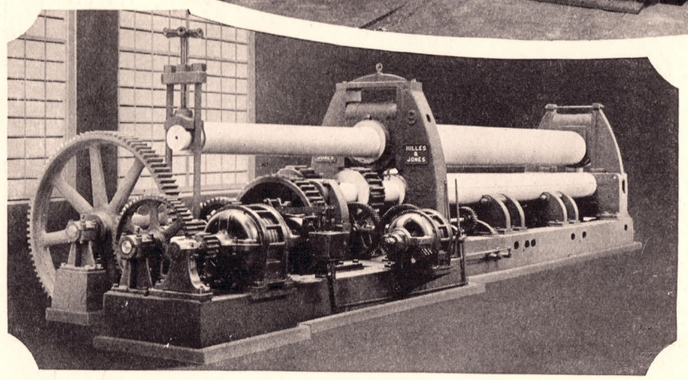


Fig. 10 — This set of pyramid rolls—largest ever built — permits Heine Boilers to be constructed in sizes and plate thicknesses called for by the most recent demands for high pressure and large capacity.

Heine Boilers are manufactured in the two modern boiler plants illustrated above, one of which is located in St. Louis, Mo., and the other in Phoenixville, Pa. These shops are equipped with special machinery, much of which was designed by Heine engineers, to insure accurate workmanship on a manufacturing scale.

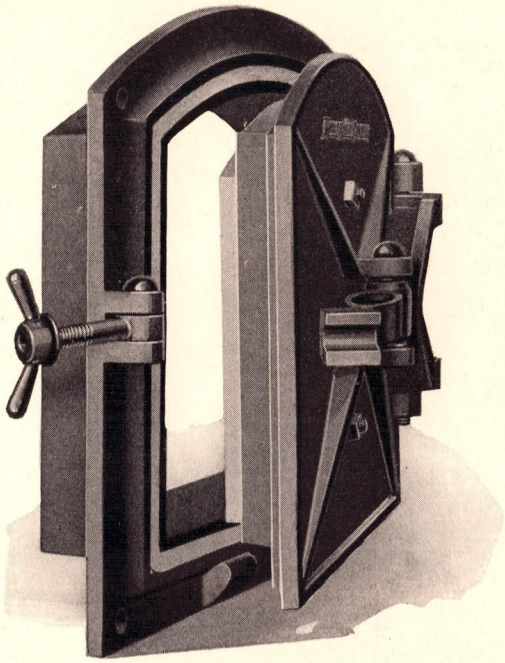


Fig. 11—Universally pivoted air-sealed cleanout door which is standard equipment for Heine V-type Boilers.

Supports, Trimmings and Accessories

THE HEINE V-type Boilers are usually supported on a steel structural frame work of columns and I-beams. The three upper drums rest in cast cradles supported by the carrying beams. The water drum is not attached to the carrying structure or the side walls thus it is free to move as the expansion of the tubes require. The boiler may also be hung from the building structure by means of U-hangers passed under the ends of each of the upper drums.

An ample number of buckstays, tie rods and universally pivoted air seal-ring cleanout doors are regularly furnished. The unique and highly desirable features of this door are self-evident from Fig. 11.

The V-type Boilers are provided with a sheet-iron upper front as shown in Fig. 12. This extends down to the fire front for hand-fired installations or to within 6 ft. of the floor line on stoker, liquid, or gaseous fuel, installations.

All boilers are regularly equipped with such trimmings as water column, safety valves, blowoff, feed and check valves of standard manufacture to fit the requirements of the purchaser.

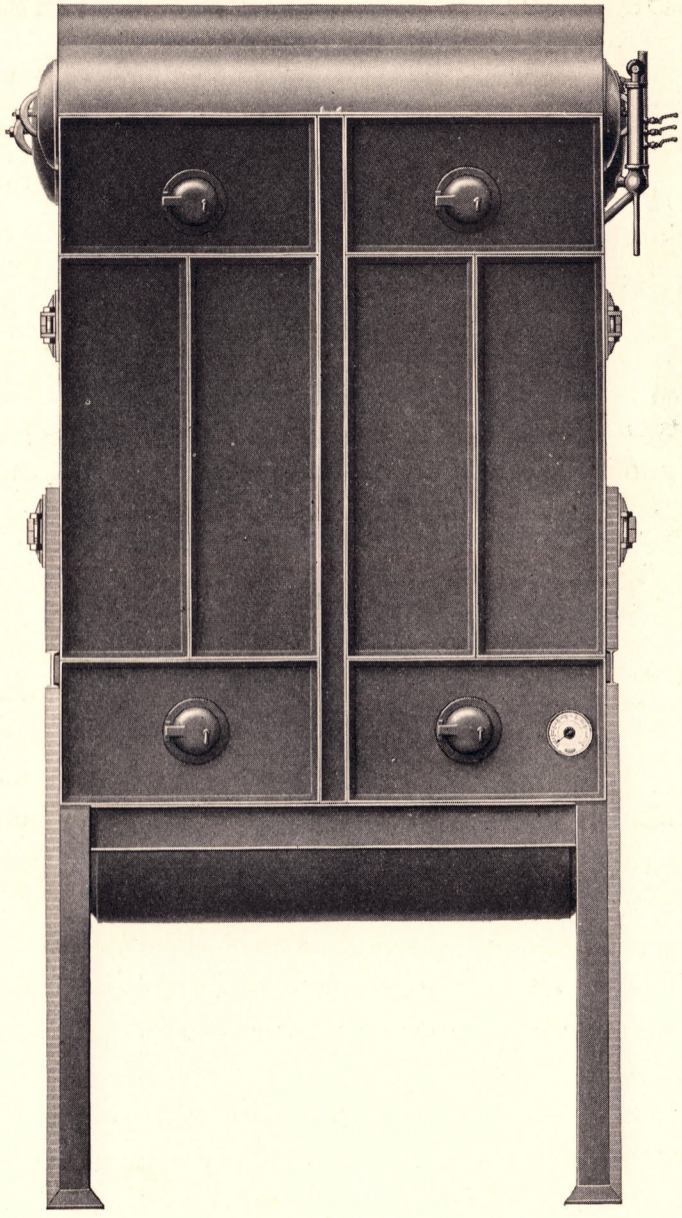


Fig. 12—Steel plate upper front for Heine V-type Boiler set singly.

Superheaters and Soot Blowers

HEINE V-type Boilers can be readily equipped with any of the well-known types of superheaters as shown in Figs. 15 to 19 inclusive.

The V-type tube bank arrangement can be easily cleaned by means of hand lance or any of the well-known patented mechanical soot blowing systems.

Sizes and Pressures

HEINE V-type Boilers are regularly built for pressures up to 325 lb. per sq. in. and in sizes from 250 to 3800 hp.

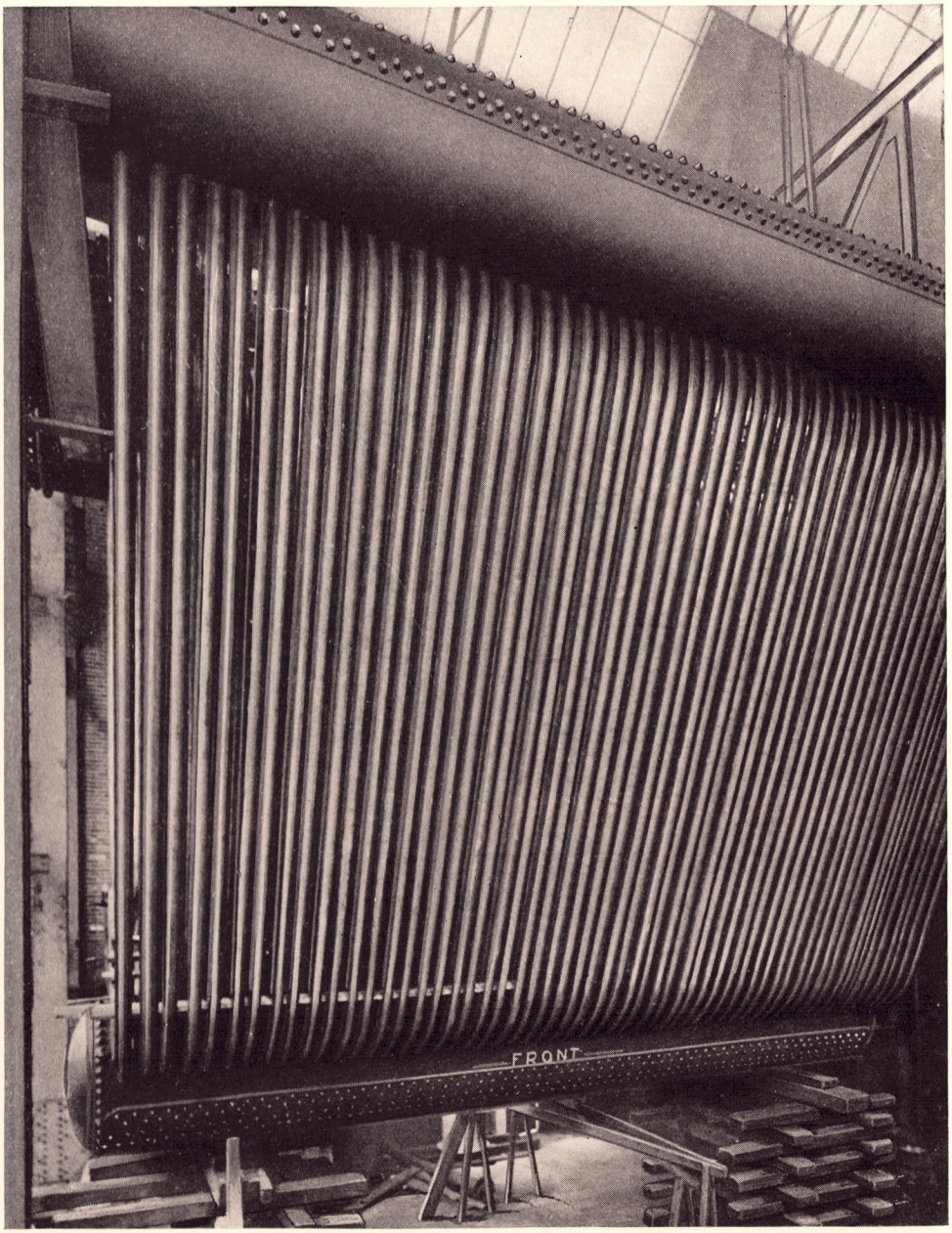
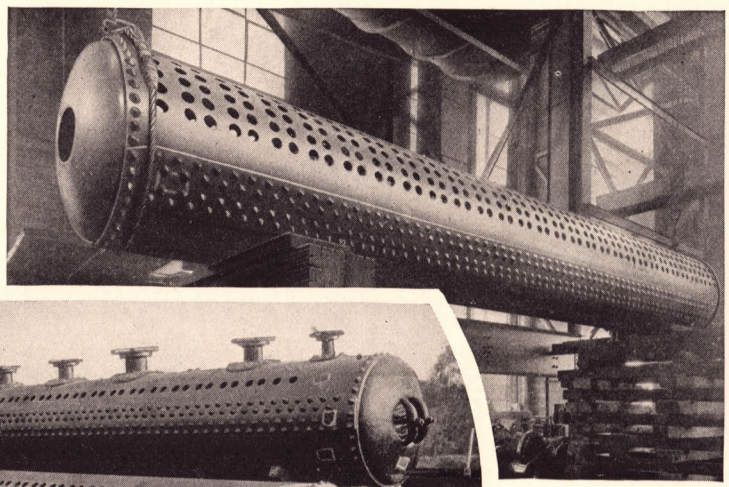


Fig. 13—Heine V-type 1500-hp. Boiler partially erected.



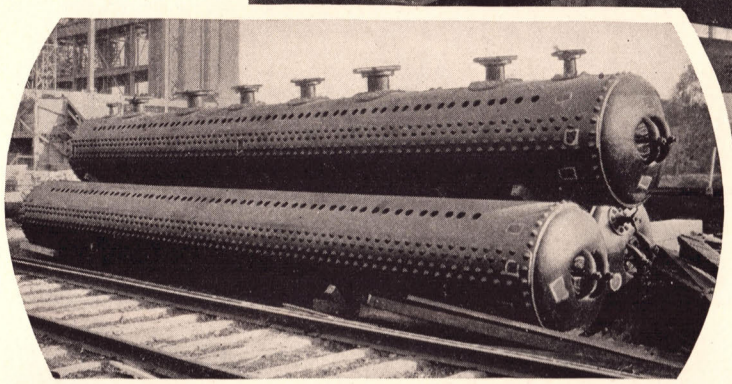


Fig. 14—Heine V-type upper and lower drums in the field ready for erection in a 1500-hp unit.

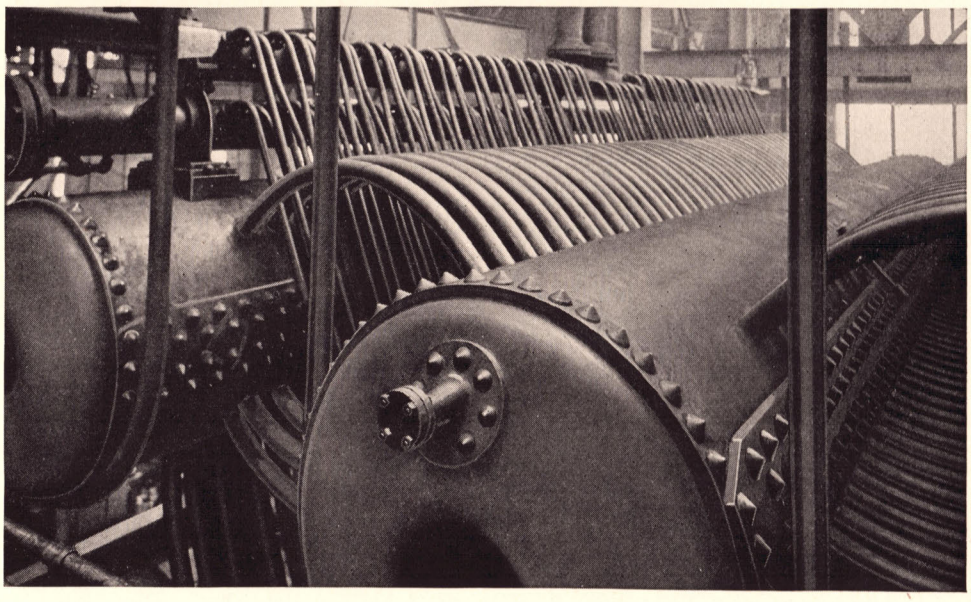


Fig. 15—Close-up of top of Heine V-type Boiler in process of erection showing superheater in place.

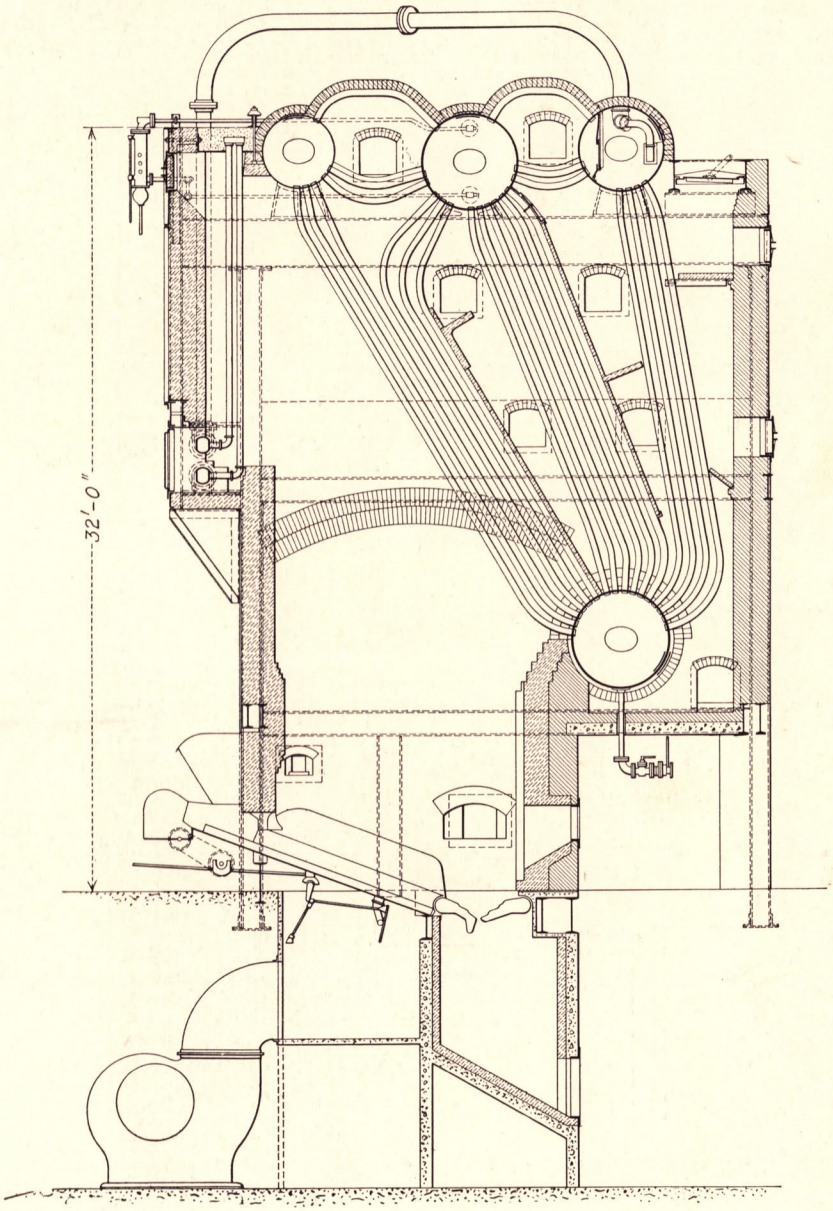


Fig. 16—Heine V-type 504-hp. Boiler arranged with three tube banks, baffled for three passes and equipped with the Foster superheater. This boiler is installed in an electric power plant.

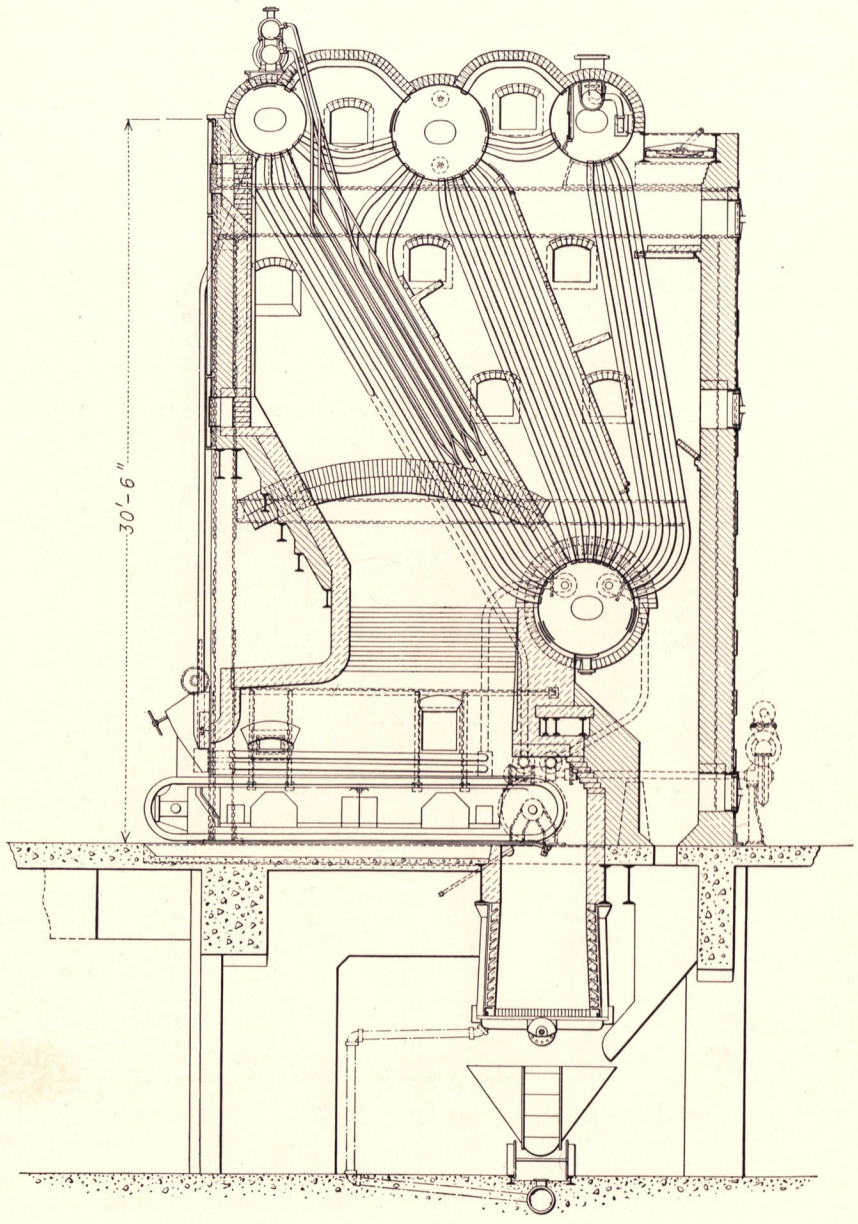


Fig. 17—Heine V-type 812-hp. Boiler equipped with Elesco superheater; two of these have recently been installed in a steel plant.

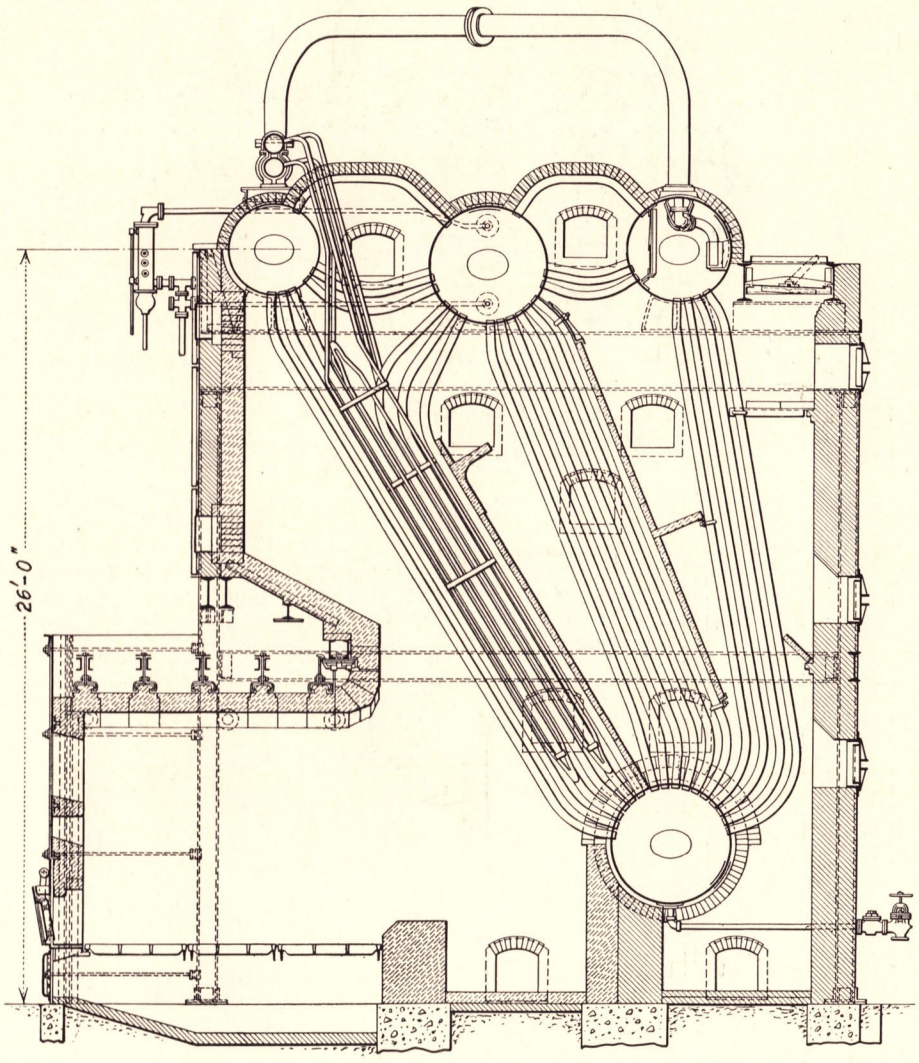


Fig. 18—Heine V-type 617-hp. Boiler arranged with three tube banks baffled for three passes and equipped with Elesco superheater; five of these have recently been installed in a steel plant.

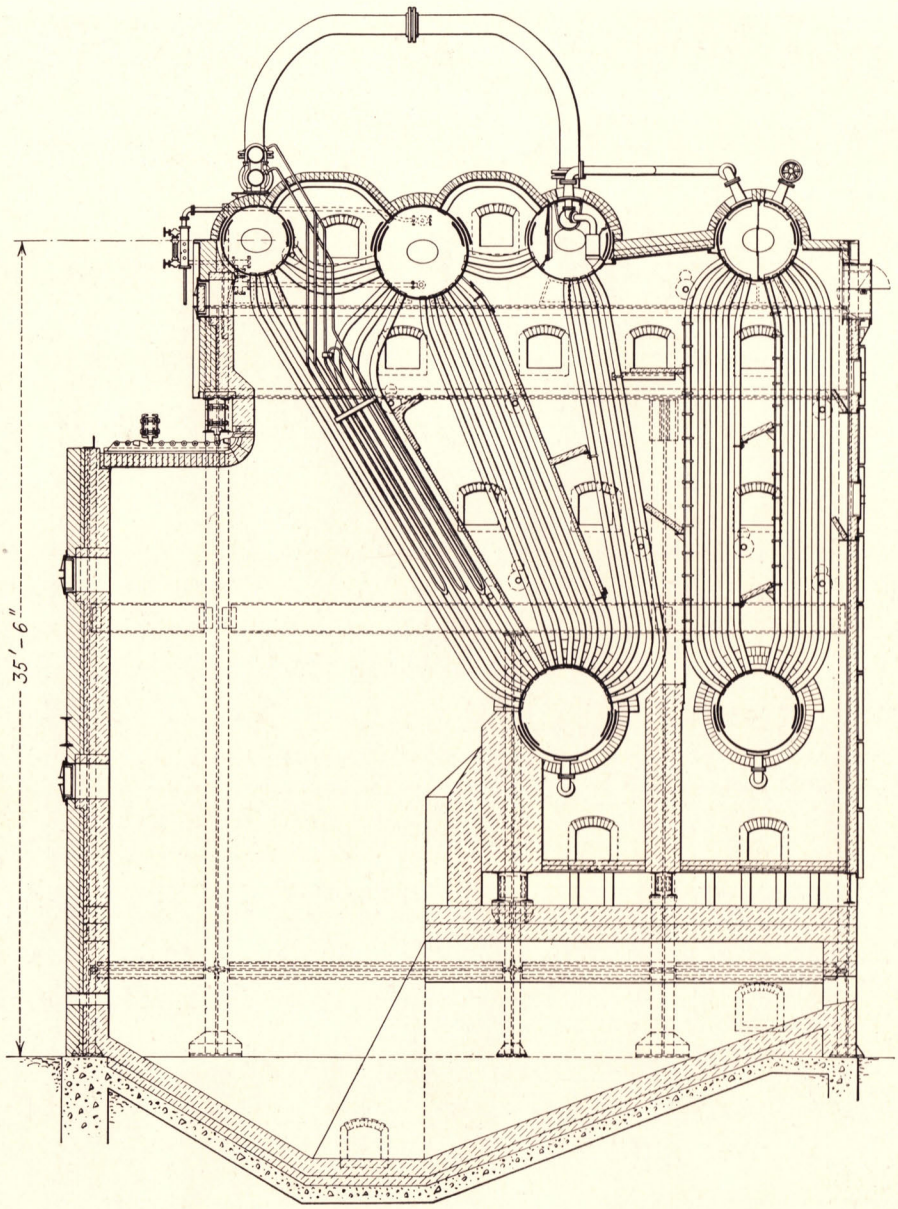


Fig. 19—Heine 1204-hp. V-type Boiler equipped with 6740-sq. ft. integral economizers Two of these units are installed in a steel plant, arranged to burn blast-furnace gas, fuel oil or powdered coal.

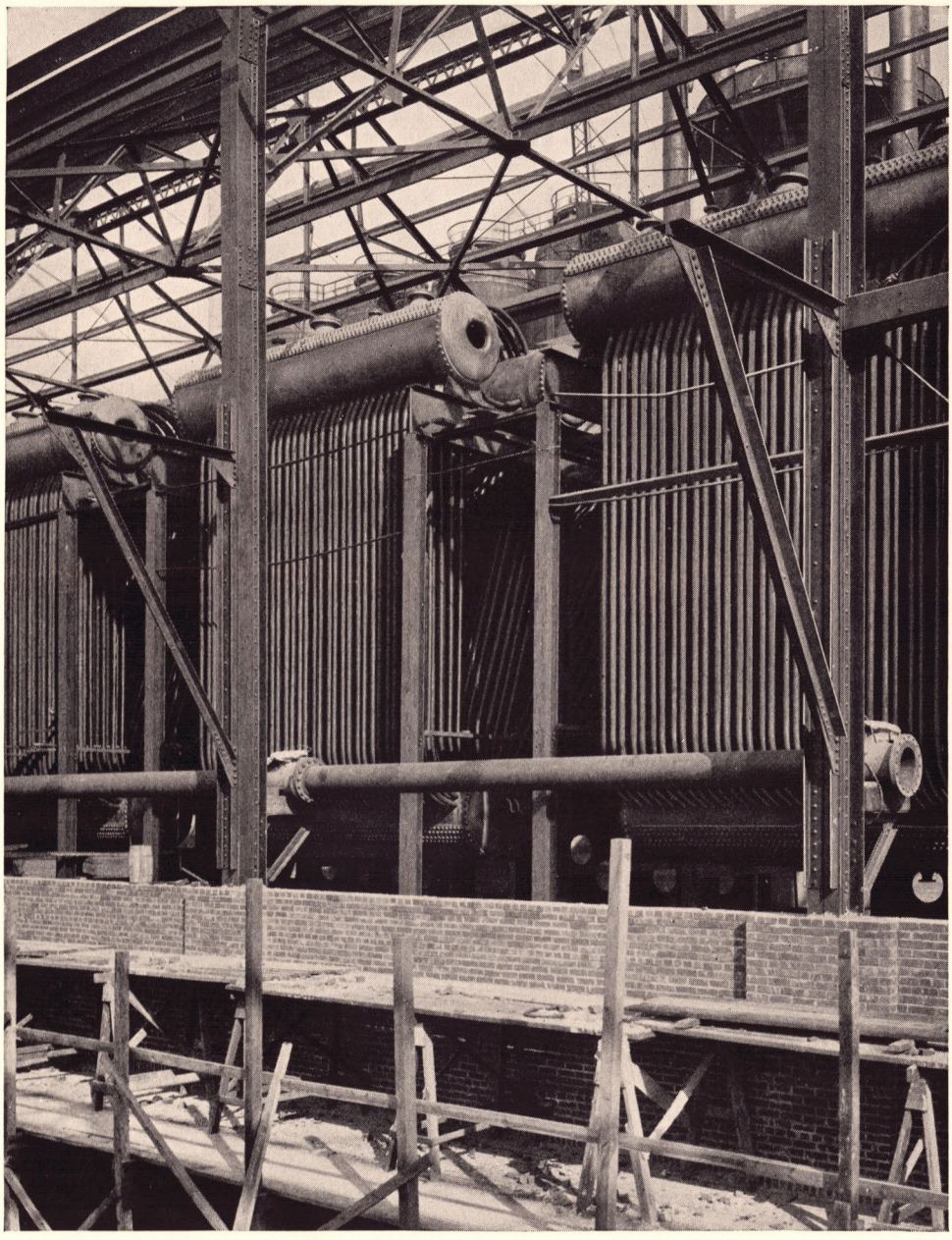


Fig. 20—Three of a row of seven Heine V-type 810-hp. Boilers installed in a blast-furnace plant and equipped to burn blast-furnace gas.

Combustion Engineering Corporation

International Combustion Building
200 Madison Avenue, New York

Boiler Manufacturing Plants:
St. Louis, Mo. Phoenixville, Pa.
Chattanooga, Tenn.
(Two Plants)

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